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ABSTRACT

The nature of successful enterprises ("special facilities") is explored to assist an inquiry into economic development that was conducted by the Business Council of Pennsylvania. An extension of the concept of a "site" is examined as an organized way of looking at the many successful enterprises. The process of selecting sites for businesses in different environments provides a basis for classifying different kinds of special facilities. Rather than operate under a common set of attributes what these enterprises have done is establish an unusually productive position in a particular environment. Seven types of environments are distinguished: entrepreneural, concentrations, industrial surges, community nexus, spin-offs, multiple partnerships, and long-term development. In each instance, the nature of the special environment is described, and examples of special facilities or positions are presented. Where possible, policies that appear to enhance achievement are briefly noted. Eight propositions are drawn from the literature to provide a basis for policy to support economic development. A three-page bibliography concludes the document. (SW)

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THE NATURE OF "SPECIAL FACILITIES": AN EXPLORATION

Prepared for
The Business Council of Pennsylvania

by

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ABSTRACT

"Special facilities", enterprises that generate exceptional returns in a variety of forms, do exist and in significant numbers. Rather than operate under a common set of attributes what these enterprises have done is establish an unusually productive position in a particular environment. Seven of those distinctive environments are identified. Also noted as propositions, not conclusions, are some of the problem areas for public policy.

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A - INTRODUCTION

1. The Idea of Special Facilities: This essay is the product of a "hunch". However, the origin is not in the kind of simple random impression we usually associate with that word but rather with a deeper intuitive sense rooted in experience and leadership. As the Business Council of Pennsylvania pursued its formal inquiry into economic development through task forces, some of its members caught glimpses of something slightly different, indefinite in character but significant enough to warrant more examination. What they saw, here and there, was an occasional enterprise that appeared to yield outcomes that exceeded all the usual expectations. These outcomes differed but they added up to exceptional benefits for the public interest. High yields took the form of new jobs, technological leaps, advances in market position, stimulation of related businesses, spin-off enterprises, and rapid capital formation often accompanied by strong profits.

The central question posed by this observation is, "What is the nature of these 'special facilities'?" Related questions come quickly to mind: In how many situations are there echoes of this "special facilities" idea? What factors are involved in these situations and in how many different forms or patterns do they appear? To what degree can the favorable conditions found in these enterprises be duplicated or applied more generally?

2. Approaches to the Topic: It is obvious even at the outset that all such questions cannot be answered in these pages. This is an exploratory essay on an elusive topic, not a systematic piece of research based on extensive analysis of field data. Stimulated by the wisdom of others, in this case the Business Council observations, it probes the existing reports and

summaries of economic development, efforts which are by now extensive and varied, to find some pattern of community. The procedure followed here has been to look across the landscape of literature on economic development and pick out features that point toward an explanation of "special facilities." It takes the exploratory form because the first examination of "special facilities" turned up many candidates, too many to deal with individually. This suggested that there may be different kinds of special conditions that operate to stimulate high yield facilities. Thus a first step has to be the development of a framework in which these enterprises can be compared.

There is no shortage of material cataloguing in a descriptive and journalistic way the correlates of successful development. The Research Triangle in North Carolina, for example, is described or referred to by just about every article that reaches print. Entrepreneurship is described in dozens of ways, all substantially the same. What is new during the past four years is the probing, comprehensive analysis of regional situations presented in such excellent reports as the Battelle study for New York state (Battelle, 1982), the McBer work for Connecticut (Jobs for Connecticut's Future, 1986), and the SRI International summary made for the American Association of State Colleges and Universities (SRI International, 1986).

Not so extensive and still needed is the vein of literature that treats economic development in a more speculative and exploratory manner. Neither is there much in the way of careful historical accounts of the type once sponsored by the Newcomen Society. It is into the framework of speculation rather in the exact setting of expertise that this essay fits.

In the sections that follow, consideration is first given to an extension of the concept of a "site" as an organized way of looking at the many

successful enterprises. The process of selecting sites for businesses in different environments gives a basis for classifying various kinds of special facilities. Each of the environments is discussed and illustrated. Finally a set of open, debatable, and somewhat impressionistic propositions are presented based on the articles used for this paper.

B - SITING: THE CONCEPT EXPANDED

1. The Importance of Location: The selection of a physical location, a site, for a facility has long been recognized as a major business decision that brings together all the components critical to vigorous economic development. Because location played such a very large part in the placement of older production facilities dependent on raw materials and market-based enterprises dependent on transportation the topic has been, by force of history, the central one in studies, consultations, and recommendations. There are periodical publications devoted to the topic, The Site Selection Handbook is one, and advice on the process can be had through consulting services that range from architects to urban planners.

There is little doubt that "placing" is critical to a production facility which is dependent on flows of raw materials from sources and finished products to marketing areas. These enterprises depend on physical through-put of people and goods. How critical the geographic site may be for information-based enterprises and service companies is not yet clear. However the issues raised by a prospect of physical relocation always compel organizations to look rationally at every aspect of their operations. At times the process of relocating is even used as a convenient instrument for making organizational changes that have little to do with physical location. One expert has observed

that firms now tend to move away from problems more often than in pursuit of opportunities. Because of this instrumental importance, there is a rich body of general information and a growing fund of data on industry-specific siting factors.

2. Expanding the Idea of "Site": The concept of site factors and siting becomes even more powerful if we transpose the idea from a simple matter of physical location in a spatial universe to the locus in a number of other universes or environments in which a facility operates. "Site" can be thought of as a position in each of the universes or environments that holds significance for the enterprise. The notion of a "market position", actually a site in the product array, is already well accepted. Companies are attentive to all aspects -- share, product type, new products, sales modes -- that define their position in that universe.

There are other universes. Consider the position (or site) a company holds in the universe of technology, high, low, or medium. A shift in position means, today, means all kinds of related changes that might have been ignored a decade ago. The site of the enterprise in the world of theory, information, and intellect is an important component of planning. A position in the policy environment made up of regulations and practices now in general use can be important. We see this policy environment manifest in dozens of forms from areas of liability and risk to the areas of duplication and product security. There is a set of site factors operating in the relational environment made up of similar, complementary, and supplementary firms and organizations. In short, it is useful to extend the idea of "site" beyond simple geography.

The extension of "site" from physical location to an analysis of position in varous kinds of environments is a logical outcome of what has, in fact, happened to the economic world. The transition from an industrial production model as the single format for an economic enterprise to the multiple forms of today's economy, -- information-based firms, and varied service enterprises, -- has created new kinds of environments. We still follow an analysis of siting factors as if physical location were the commanding single issue. As an example, take this segment from Battelle,

page viii (emphasis added).

Engineering-Development	Research Orientation	Production
Available professional, technical staff	. High quality of life	Total costs
Excellent support staff	. Major universities, technical schools	Taxes
. High quality of life, educational systems	Transportation	. Work force
Excellent transportation	Reasonable costs, taxes	Transportation
. Good work attitudes	. Local pool of professional talent	Utility costs, availability
Reasonable operating costs	Supporting services	. Educational programs
Acceptable facilities,sites	. Pool of technical staff	Supporting services
Dependable utilities	Sites, structures	Sites, structures
Taxes	Dependable utilities	. Community attitudes
	. Proximity to operating units	. Quality of life

As one looks at this list of siting factors held to be important for high technology companies, it becomes very clear that not only the factors, especially the checked ones, but the universes from which they are drawn have changed. These suggest, in short, new environments in which position must be considered.

Whether this idea of looking at "site" as a set of positions in a variety of environments has general applicability remains to be seen. It does find endorsement in a paper prepared for the U.S. Congress:

> No single element is responsible for the seemingly spontaneous and spectacular growth of high technology in these regions (Silicon Valley and Rte. 128, Boston). Instead a combination of factors, including research and teaching activities at great universities, a rich endowment of labor skills, venture capitalists, high technology entrepreneurs, and Federal procurement activities in the area are intermingled to provide the intricate fabric of a 'creative environment' that underlies the economic dynamics of the region.

In the case of special facilities, the topic of this essay, we find that many of the enterprises are responding very successfully to conditions in one or more particular environments. That makes possible a set of distinctions, a typology of special facilities, based on the environmental set. Certainly this does not even suggest that positions in other environments are not important. Many of the units mentioned below could be put into more than one category. In sorting out what is "special" about special facilities a set of categories based on a broad notion of siting may be helpful.

3. Varied Environments: The puzzle surrounding special facilities that yield exceptional results gets complicated very quickly by the variety of successful activities that can be identified. Attempts to factor out the major attributes associated with high yield enterprises give only obvious answers. No less an authority than the Wall Street Journal, for example, recently concluded its special supplement on "Small Business Opportunities" (May 19, 1986) with a "Back to Basics" recommendation, as the key to success: stick to what you know, look for stability, get proper capitalization, etc. Searching for a better way to get at the success of special facilities we were led to the perennially valuable site selection process, a proven device for

organizing business factors into a pattern of relative significance and priority. If the idea is expanded to include a consideration of positioning or siting in other environments or universes it is possible to learn more about specialization. Special facilities appear to fall primarily into a success pattern built around a particular environment.

Seven kinds of settings can be discerned each displaying some special facilities that are responsive to that setting. These are, "entrepreneural", "concentrations", "industry surges", "community nexus", "spin-offs", "multiple partnerships", and "longterm development". These labels are not self-evident and will be considered in detail. We take them up from simple to complex. In each instance the nature of the special environment will be described and examples of special facilities or positions presented. Where possible a brief notice is given to policies that appear to enhance achievement.

C - SEVEN ENVIRONMENTS

1. Entrepreneural: There is not the slightest question that there is an environment, re-emerging some would say, in which flashes of enterprise and bursts of entrepreneural ability can stimulate exceptional results. Expressions of entrepreneurship have become the substance of legend in the popular mind as well as in the accounts of economic develoment specialists. They make very good "press". The reasons are perceptively summarized in the recent remarks of Ronald Shelp, vice president of CELANESE CORPORATION (1985):

> . . . my experience is that making money is not the primary motivation (of the entrepreneur). Higher up on the list is the desire to be independent.
>
> . . . The entrepreneur is respected. He has become a cult figure. So we have stamped him with a seal of approval and put a premium on his value to society. This is the right environment. It is better than all the legislative incentives we could devise.

Such individualized risk taking is usually focused on a single product or service area, an attribute which allows a high degree of personal control. Usually it is a low tech enterprise for which a market niche in some form already exists. Most often the activity is relatively independent of the policy structure and very responsive to investments of personal energy and emotional drive. Just about every experienced economic development unit has illustrations of success in the entrepreneural environment. There are running accounts in Nations Business under the series entitled "Strategies for Success", in Forbes "Up and Comers", in Money's "Bold Moves" series and in Fortune's "Products of the Year." In Pennsylvania the reported entrepreneural successes include such widely varied efforts as Keystone Scientific, working in chromatography; Atlantic Tool & Die, machine tools; Software Consulting Services (SCS), graphics layouts; Bennett Medical Systems, blood collection procedures, to cite just a few.

Policies to advance entrepreneural activity consist of peripheral technical and financial support services but the main role of public bodies is to get out the way. Like most states Michigan has a Small Business Commission--Pennsylvania's are regional--but the Lake State also has a State Research Fund that makes grants for product research to aid directly entrepreneural development. Training in business procedures to give more stability to new enterprises is offered widely (National Governors Association, 1983; Michigan, 1985). PENNTAP offers low cost, highly expert technical advice to small business and has become a national model.

The incubator idea is widely followed: Ben Franklin Partnership Advanced Technology Centers are one good example. Commercially the incubator concept has been characterized by brokering activities that seek to connect

entrepreneurs with local business opportunities--Acquisition Associates is an example--or seek to turn technology transfers into profits--University Patents Inc., Aladdin Industries and Research Corporation. (Daviss, 1985; Nelton, 1984).

The entrepreneural environment is energetic, volatile, and risky but it is well understood and supported.

2. Concentrations: There is a class of facilities that draw in around them a variety of contingent and commercial enterprises. Established and "sited" as a single unit they have much broader consequences thus becoming special facilities. In many cases the beneficial results are highly predictable and competition to bring them in is keen. The location of "super computers" is a current example, interesting in part because there are unpredictable elements. Cornell and Boston University offer quite different physical settings but are competing as similar intellectual environments. The decisions of General Motors on the Saturn plant, the location of Michelin tire in South Carolina, and the placement of HONDA of America all created a concentrated environment. Government laboratories, corporate headquarters, and major defense installations have centripetal effects. Certain real estate developments like Baltimore's Inner Harbor have the capacity to influence strongly the revitalization of the downtown area. An experienced developer has observed that, in an information/service environment, the choice of a place to live by chief executive officers is followed by a movement of corporate headquarters to nearby locations. High or very high quality residential areas may be one of the newest factors in siting. What is less clear than the promise of future benefits are the circumstances surrounding non-

success of past efforts at concentration. Needed are some studies of the effects, over time, of concentrated sitings. What, for example, are the negative consequences or adjustment requirements of a sage in the microchip/-integrated circuit market for Silicon Valley? We have evidence of a kind in the petroleum industry decline for Oklahoma and the closing of steel in Pennsylvania and Ohio but how can "concentrations" be given the stability that marks some of the European concentrations, the Ruhr Valley or the SAAR for example?

3. Industrial Surges: Another kind of environment in which a greater than expected body of results appears is one in which a whole industry is propelled forward usually by some new combination of external factors. Special facilities emerge from those organizations best able, that is best positioned, to move with the flow. The history of what happens when such an environment of opportunity appears has been given some attention but not in the detailed way that would provide insight. In the past two decades the cable TV field has demonstrated this surge effect and recent articles by T. Whiteside (1985) give a good narrative account of what happened. The developments are not without their dramatic events as the networks and motion picture companies tried to turn back the tide of individualized entertainment. Whether that surge of cable TV will in turn be outrun by video cassettes or subsumed by satellite transmission is an interesting question. The point is that, once opened, these new industry environments generate widespread economic benefits. Pennsylvania happens to be the original site of cable TV and has within its borders several major "special facilities" that, partially, are

products of it, C-Cor, AMP, and Jerold Electronics for example. A related surge in satellite transmission industries is now apparent.

Industry surges are often predictable. It is clear that the whole field of health care delivery is propelled into change by the aging population, emphasis on positive health and fitness, and new forms of treatment. Pennsylvania, given its population, medical schools, pharmaceutical companies, and financial institutions is well-situated to generate new "special facilities." Examples of companies moving with this growth area are IMMUNICON, with á specialized blood technique, and ZETACHRON using polymer chemistry to develop controlled dosage. American Medical Buildings Corporation moved into a medical service satellite system.

The surge phenomenon is also quite visible in the development, production, and marketing of computer software. At first it appeared that strong concentrations of software companies around particular geographic locations would be the pattern of the future. Now it is clear that other factors such as a critical mass of diversified users and developers are asserting an influence and software companies are scattered. Again, a historical study of the development of highly effective enterprises in this field, Microsoft, Borland and the like, would be instructive.

Scientific surges may be a special case in this general category. Olsen (1986) presents biotechnology as a field new in its own right but connected in all directions to the traditional disciplines. These traditional disciplines often have long standing ties between university departments and a production field. The Research Laboratory for Applied Chemistry at MIT goes back to the 1920's. Cal Tech's affiliation with aeronautics and the University of

Illinois' Chemistry Department also hold good positions for participation in the surges that come to related fields.

There are quiet surges as well. These are discernible in the field of financial analysis, (e.g. Wall Street Journal, May 12, 1986). Financial services as a field is stimulating activity not only in banking and accounting but also in travel, insurance, and investment. The communications field will build steadily on data transmission, diversified services, and new technology and carry with it a large complex of small manufacturers, service companies, and marketing units.

The obstacles to upward surges of a new industry or science are especially difficult to deal with. Very often, as is the case in health care, regulations in several different areas combine to produce tangled barriers. Several State departments in Pennsylvania deal with nursing home approvals, -- Licensing and Inspections, Labor and Industry, Health -- and getting a coordinated solution is difficult. With cable TV, for example, the state persisted in treating the enterprise in the context of a public utility rather than as a consumer purchase. A method of looking across the regulatory structure in more creative ways can be developed at the state level. One state, Michigan, is experimenting with an "ombudsman" to untangle such obstacles. The importance of "policy development units" like governor's technology councils in these situations has been acknowledged by The National Governors Association (1983).

4. Community Nexus: Communities themselves can exercise enough initiative to develop environments favorable to high-yield enterprise. Often this is the result of networks or linkages, hence the term "nexus." In contrast to

the previous environments discussed less is known about how communities reach high levels of effectiveness. Norman Tyler at the University of Michigan College of Architecture and Urban Planning is studying the revitalization of small towns. The interesting feature of his research is that it literally explores the nexus by combining the views of experts, city planners, political leaders, and business men with the views and historical perceptions of long time residents and young people.

In Pennsylvania the state and local governments show the fragmentation built on historical distinctions. Councils of local government still reflect strong regional differences that may make coherent statewide policies difficult.

Michigan has moved to an incentive system just begun but promising in the Communities of Economic Excellence Program. The notion of "community growth alliances" that deal not only with the infrastructure but also directly with the promotion of a diversified business base (Michigan, 1985).

What makes the cultivation of local environments feasible as well as necessary is that the "sunbelt/frostbelt" phenomenon has lost much of its impact. Moving out of obsolete buildings with high taxes and rigid labor traditions was a phenomenon of the 1950's and 60's. It is, according to Berman, (1985) largely over as a result of changes in the north and a re-emphasis of traditional factors of importance to the conduct of business. Berman (1985) cites data from Industry Week which interviewed 1000 executives on the importance of site selection factors. Ranked by frequency these run: Geographical location and high worker productivity at the top. In the next set land transportation, low union profile, stable state government, skilled labor availability, long term financing energy sources. Only then do tax

credits and exemptions appear, mainstays of many state programs. Rail and air transportation, and worker training programs are lower. The pattern of these choices, apart from its stability over time, reflects the high importance of local communities and lesser role of traditional development incentives. Getting good executive talent is even more dependent on the community environment. MBA's rated housing costs and availability among the top factors in a move with employment for spouses just behind. Again, community based factors, conditions that produce "special facilities" that generate multiple outcomes now reach to the nature of the whole community, not just to the environment of an industrial or research park.

5. Spin-Offs: The importance of this environment for economic development is signaled by evidence in statistical reports. It has been known for several years that the largest share of new jobs comes from recently initiated small businesses. However, a more careful analysis by Brookings Institution economists demonstrated that the lasting small enterprises were, in fact, spin-off's or subsidiaries of larger companies.

These satellite endeavors show various characteristics. Some are explorations into high risk areas. The parent firm wishes to circumscribe both possible losses and responsibility. Others are "technology transfers" where staff at a large company take hold of one area of opportunity. Control Techtronics in Pennsylvania is an example. In other cases large corporations are dropping activities that are marginal to their central functions and they are packed up by others who see the potential.

Generation of spin-off enterprises has apparently increased. For a state to foster these promising efforts a high degree of liaison between state

bodies and the major corporations is required. It has been relatively easy to find examples of "special facilities" in the spin-off mode but information on policies followed by states to encourage and develop this valuable source of new enterprise have not been located.

6. Multiple Partnerships: Of all the contributions the United States has made to the world of business none is more important than the invention of new organizational forms. Now, pressed by technology and high capital requirements, by market differentiation and product evolution, the economic world is experimenting with new ways of bringing private corporations, public bodies, and non-profit institutions into productive alliances. Of all the environments in which "special facilities" exist this is the one that presents the greatest complexity and the greatest promise.

> Particularly vexing are the organizational and operational problems. U.S. firms traditionally kept to themselves any research results that might have given them a competitive advantage. 'Fundamentally, companies didn't want to cooperate and they found anti-trust laws a really good reason not to,' says William C. Norris, Chairman and CEO of Control Data Corp. (Minneapolis). One unfortunate result of this secretive attitude was a shameful and needless duplication of effort' (Davis, 1985).

A prototypical design involves a relationship between university research, corporate production and marketing, and government facilitation through financial support and policy modification.

> 'One of the first R & D consortia, the Semi-conductor Research Corp. was founded for many of the same reasons (as MIT's Advanced Television Research Program) . . . to make bright young scientists recognize. . .technical challenges.'

The Ben Franklin Partnerships and the associated activites, Advanced Technology Centers, stand as examples of a good beginning but they are only a small beginning on a very large prospect. One striking feature of this

phenomenon is its world wide character (British Technology Group, 1984; OECD, 1984). In the U.S. detailed attention has been given to these relationships since about 1981 (Johnson, 1983; SRI, 1986; NSF, 1984).

The partnerships now emerging generally aim at deep-rooted technical and scientific issues, often involving complex and expensive research technology, several different bodies of experts and many unanswered questions. There is a potential for very high value to the solutions both in the market place and in the realm of knowledge. One controlling element in these partnerships is the nature of the product line. NSF observors have pointed out that where product lines are fairly simple and reasonably stable over time then there is little advantage to corporate alliances that open private and specialized company knowledge or personnel to competitors. For example, most agricultural products are quite uniform so companies gain and maintain advantage over competition by small, relatively small, and closely guarded improvements in delivery and marketing. There are large areas where the agricultural research design of the land grant university with its extension and field research is a good model. The partnership with industry is "loosely coupled" and corporations are free to take from the public domain those research results that are useful.

The network of research endeavors supported by public investment needs only to be catalogued and made accessible to be useful. Germany has such an information network, a switchboard, based at BOCHUM and DORTMUND universities with the title UNIKONTAKT. France has a network of regional delegates, the ARIST's, who are trained to know the information sources useful to small businesses (OECD, 1984). The Japanese have carried information exchange one step further by Japan Research and Development Center (JRDC), an agency that

organizes proposals, selects performers, and facilitates licensing meanwhile funding the essential costs (OECD, 1984). Typical U.S. examples are the faculty exchange center at the University of Illinois, the Industrial Affiliates program at MIT, and the Pennsylvania Research Inventory Program at Penn State. These "switchboard" endeavors are mere beginnings on the kind of rich, informal networks by conferences, visits, personal meetings etc. that must be developed to insure rapid translation of technique into production. Switzerland is considered the most advanced economy in these association and it is significant that research support from industry is higher there than anywhere else, 12% of total research investment compared to just over 2% in the U.S.

More direct and specific partnerships have been appearing in the last decade. These have generated a great deal of discussion about how the quite different interests of university researcher and corporate scientists or managers can be accommodated (Varrin & Kukich, 1985). The Pajuro Dunes Conference in 1983 and subsequent discussion has made it quite clear that guidelines can be developed to respect the varied interests of participants. There are also some organic differences based on the size of the corporation. Large enterprises tend to favor in-house research units while mid-size and smaller firms look for more extensive assistance and information exchange through consultants or cooperative agencies.

Simple, direct two-party partnerships have been around for some time but the size and scope of several recent agreements with HARVARD and WASHINGTON UNIVERSITY together with the HOESCHT compacts with Massachusetts General Hospital and Harvard are long term, rather open ended agreements. Easily controlled for mutual advantage these arrangements are likely to become

widespread among more specialized academic research institutions and industries with parallel concerns.

Consortia among industries, sometimes with university participation, have emerged very rapidly in the past six years. Examples of multi-corporate involvement are Semi-Conductor Research Corporation (N.C.), Microelectronics and Computer Technology Corp. (Texas), Oncogen (Wash.) Center for Advanced Television Studies (Mass.), and Chemical Industry Institute of Toxicology (N.C.). While it would appear that Pennsylvania with its concentrations of special science-based industries like pharmaceuticals, machine tools, and control equipment is a likely location for both partnerships and R & D consortia the State has been slow off the mark in establishing them. Admittedly these are complex and guarded efforts but the idea of having problem-focused research of importance to a whole industry holds a prospect of great efficiency and wide economic benefit.

Even more complex and also more interesting are the multiple agreements that link one or more industries with one or more universities, often with federal and/or state assistance. The affiliation of R.P.I. with more than 100 firms with an interest in computer graphics is often cited as a case in which the university, in pursuit of its own goals, became a magnet for industries with similar needs. A major component of these arrangements is always a special competence in the academic setting. OECD put the matter succintly, "excellence in university research is a prerequisite for fruitful collaboration with industry." Clearly one difficulty in generating lasting agreements lies in the fact that the educational institution is called upon to concentrate its resources thereby sacrificing broader but thinner coverage of research topics that span the whole range of public interests. This kind of

selective concentration raises a policy dilemna for public universities about where to make the emphasis particularly where there is a long tradition of generous public service across many fields. The necessary condition, of course is a better understanding by public officials of the essential requirements for economic advancement in a scientific, technological, and global system.

The National Science Foundation has built considerable experience with its University-Industry Cooperative Research Centers, a program in which Pennsylvania is well represented (NSF, 1984; Tornatzky, 1982). These are carefully planned, jointly funded enterprises that are focused on a particular area of technology or science. Nevertheless there is room for creative approaches and there is an experimental quality to many of the projects. Most of these Centers gave considerable attention to the nature of relationships with industry in the founding stages, a critical variable. The most active area right now is biotechnology and the promise is so great in this multi-disciplinary area that there will be room for many different approaches. Sweden, Holland, Germany, and the U.S. are principal actors with the main task being one of identifying which combinations of universities and industries are best fitted to particular research areas. Equally attractive is coordinated research in telecommunications especially in countries like Canada where large land masses are a challenge to communication in all forms.

The creation of a physical location as driver and catalyst for research and development represents another medium for multiple partnerships. The Research Triangle in North Carolina, a product of Dr. W. Odum's ideas first put forth in the 1940's, has about twenty years of experience with the cultivation of R & D enterprises in many forms set in close collaboration with the universities. In the U.K. Cambridge University set up a park on its campus,

Herriot-Watt Research Park, 1974. Princeton University has created the Forrestal Center as a location for specialized research endeavors and is extending its functions to include a variety of service operations. By no means all "research parks", sometimes created by belief's that just short of magical, have been successful. The necessities are an open nurturing policy environment in which government has the capacity to make substantive studies and enact effective legislation, universities that have a sound basis in scientific, technical, and scholarly research built up around a superior faculty, and interests from business enterprises, usually large corporations, in commitments to long term agreements. Lead time and "Sunk" costs are not negligible but are easily clouded by excessive enthusiasm.

7. Long Term Development: In all of the environments mentioned so far, entrepreneural, industry surges, concentrations, spin-offs, community nexus, and multiple partnerships, there is some likelihood that goals, however distant they may be, can be discerned and understood. However, studies of major scientific and technological breakthroughs demonstrate that, long before goals can be stipulated, research efforts are underway that have only a direction, not goals. These directional research efforts, investigative and speculative work on classes of phenomena or broad problems, often proceed without any particular interconnections until, prompted by a specific discovery, they converge fairly rapidly toward a major breakthrough. A classic study at the Illinois Institute of Technology, the TRACES project, conducted a retrospective analysis of five major "inventions". Their findings have a great deal of significance for economic development based on service and technology but they have received only scattered attention. Among the findings

are evidence that 70 percent of the "effort", that is time and investment, comes in the somewhat disconnected theoretical phases while 30 percent falls in the final research and development stages. There are usually about five separate strains of fundamental research that feed into the final product. The approximate time from the first formulation of the issue to a technically and commercially sound product is fifteen years. Their study dealt with such inventions as the integrated circuit chip, ferromagnetic tape, and the oral contraceptive, all singular and transforming creations.

The long term foundations on which planned economic development occurs lie in the agencies of theoretical or basic research, usually first rate universities but also with private centers like Bell Labs., the Siemens Laboratories in Germany and selected institutes, like NIH. To maintain these enterprises and support them in stable and adequate ways is now clearly an economic act of faith as well as an act of intellectual commitment. In the most recent decade distinctions between basic and applied research have blurred away, at least at the imaginary boundary. What remains however is the fact that some kinds of research, call it theoretical or basic, have only a vague direction because the substance of their work is the unknown itself. If the evidence from TRACES is to be believed the essence of economic development fifteen years hence resides somewhere within that non-goal oriented research of today.

This environment of long term, multi-tracked research is as much a part of economic development as the entrepreneur. The danger, evident in the national policies of the U.S. since 1968 is of a gradual shift of major support in the direction of mission--oriented research away from elusive theoretical excursions. The advantages of such choices in terms of

accountability and political salience will be cancelled eventually by the failure of vision they represent.

D -- SUMMARY PROPOSITIONS

From this examination of individual "special facilities", too few to gain a sharp assessment, and the broad swath of published material, too variable to give precision, we have come to another beginning. "Special facilities" represent a successful response to a particular kind of environment. By looking at the best in each environment it should be possible to move ahead one more step toward the identity of what makes "special facilities" special.

There are also some recurrent observations and contributions to be drawn from the literature. These deserve consideration as a skeleton of policy to support economic development is put together. As presented below these statements are propositions to be turned over, dissected, and debated. They are neither assertions nor expert judgement.

1. The fact that economic development in all its aspects is a function of the rate of investment not the amount seems poorly understood. In a dynamic situation as opposed to a static one it is acceleration of investment that brings return. The failure to increase at an increasing rate the share of GNP going into productive R & D has created the drag on Western economics. This simple but vital characteristic may well be the greatest obstacle to public support in the U.S. Where there is a tendency to "hold the line" from year to year unless some tangible results are produced.

2. The time horizons for thinking and planning are still probably too short. Most of our project orientation is in the 3-5 year range with a tendency to promise quicker pay-offs providing even more tempting illusions.

In point of fact most of the major components in the environments we have looked at require 10 to 20 years to mature. Such actions as capital formation, legislative enactments, basic research, and education in the form of training or retraining are long-term challenges.

3. The nature of products and services is changing very rapidly but our thinking is fixated in an older industrial manufacturing mode. We are just beginning, for example, to get a working understanding of how the service sector has been differentiated into producer services, retail and distributive services, information services, human services, and consumer services. Each has a distinctive set of characteristics and a different combination of "critical events".

4. The traditional forms of business organization, competing firms operating in a market setting with a degree of government regulation, are ready for revision and invention. So far change has come mostly in the financial structure but the operating side is anticipated. The challenge is to discover at what levels and in which product (or service) areas corporations can join with government and non-profit units to achieve both efficiency and effectiveness.

5. The current fund of information about businesses and their operations, outside of the area of financial reporting, is very scattered, journalistic, and ephemeral. Badly needed are good histories of economic phenomena, sound analyses of social consequences of economic events, and analytical statistics of a long term nature. Folk wisdom and anecdotal evidence, however appealing, are not answering the pressing questions.

6. Public understanding of the new economic environment is a crucial component of economic development. The public will be required to finance and

the legislators required to enact policies that are more far-reaching, complex, and unfamiliar than ever before. As illustrative one can take note of three areas that cannot change without public initiative. The handling of liability risks is generating apprehension and confusion in areas as widely different as professional malpractice and product liability. In a free enterprise system risk is one element in the equation but, as John Holland of CED has observed, it must be at a level commensurate with reality of return.

7. Labor force adjustment legislation is another such area. The work force of the year 2000 is already with us, for the most part, so economic change will be contingent on "retooling" that work force current policies on unemployment look backward more to Elizabethan Poor Laws and the Factory Acts of the last century rather than toward the kind of flexible work force needed in the next.

8. Finally, there is a matter of Legislative coherence and consistency. Fragmented laws, many outmoded, will have to give way to special codifications that are in tune with the needs of developing economic environments. National anti-trust laws, for example, in a global market have turned out to be an anachronism that in many cases thwart rather than protect the true public interest.

Was the "hunch" accurate? Most assuredly there are facilities or enterprises in both the profit and non-profit sector that are unusually effective in generating jobs, opening new markets, sparking technical advances, creating spin-off firms that endure, marshalling capital from many sources, and generating profits. But they are too varied to be summarized by a simple analysis. What is clear is that they represent an exceptional response to different primary environments. This is half an answer to the question of what makes

special facilities "special". The other half lies in an examination of the individual cases within each environment.

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